

Appl. No. 10/726,498
Amendment dated February 14, 2006
Reply to Office Action of December 22, 2005

The following Listing of Claims will replace all prior versions, and listings, of claims in the application.

LISTING OF CLAIMS:

1. (Currently Amended) A braking control device comprising:
 - a forward object detecting section configured to detect an object in front of a vehicle in which the braking control device is installed;
 - an avoidance possibility determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by at least one of steering and braking;
 - an automatic braking section configured to execute automatic braking when the avoidance possibility determining section determines that the object cannot be avoided by at least one of steering and braking; and
 - a vehicle behavior response characteristic determining section configured to determine a vehicle behavior response characteristic that includes at least one of a suspension characteristic of the vehicle based on a suspension characteristic setting, a steering avoidance direction force that will be generated in the steering avoidance direction should the object detected in the front of the vehicle by the forward object detecting section be avoided by steering with the steering avoidance direction force being calculated based on a longitudinal force and a load acting on wheels of the vehicle, a change in a vehicle condition that results in deceleration of the vehicle an accelerator pedal release deceleration that will result should an accelerator pedal be released, and a vehicle-object relationship between a traveling speed of the vehicle and a distance the object and the vehicle that is corrected using a non-linear traveling speed based correction coefficient,

the avoidance possibility determining section being further configured to set a ~~method~~
~~by which control operation to determine whether~~ the object that is determined to be in the
front of the vehicle can be avoided by ^{the} at least one of steering and braking based on the
vehicle behavior response characteristic determined by the vehicle behavior response
characteristic determining section.

2. (Original) The braking control device recited in claim 1, wherein
the avoidance possibility determining section includes a steering avoidance
determining section configured to determine if the object detected in the front of the vehicle
by the forward object detecting section can be avoided by steering.

3. (Currently Amended) The braking control device recited in claim 2, further
comprising
a suspension characteristic setting section being configured to change the
suspension characteristic setting of the vehicle, and
the steering avoidance determining section further being configured to set the ~~method~~
~~by which control operation to determine whether~~ the object that is determined to be in the
front of the vehicle can be avoided by steering based on the suspension characteristic setting
set by the suspension characteristic setting section.

4. (Currently Amended) The braking control device recited in claim 2, further
comprising
a steering avoidance direction force calculating section being configured to calculate
the steering avoidance direction force that will be generated in the steering avoidance

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direction should the object detected in the front of the vehicle by the forward object detecting section be avoided by steering, and

the steering avoidance determining section being further configured to set the ~~method by which control operation to determine whether~~ the object that is determined to be in the front of the vehicle can be avoided by steering based on the steering avoidance direction force calculated by the steering avoidance direction force calculating section.

5. (Canceled)

6. (Original) The braking control device recited in claim 1, wherein the avoidance possibility determining section includes a braking avoidance determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by braking.

7. (Currently Amended) The braking control device recited in claim 6, further comprising

a throttle-fully-closed deceleration calculating section being configured to calculate ~~an~~ the accelerator pedal release deceleration that will result should ~~an~~ the accelerator pedal be released, and

the braking avoidance determining section being configured to set the ~~method by which control operation to determine whether~~ the object that is determined to be in the front of the vehicle can be avoided by braking based on the accelerator pedal release deceleration calculated by the throttle-fully-closed deceleration calculating section.

8. (Currently Amended) The braking control device recited in claim 2, wherein the avoidance possibility determining section includes

a steering avoidance threshold value setting section configured to set a variable steering avoidance threshold value for determining if the object detected in front of the vehicle by the forward object detecting section can be avoided by steering based on the vehicle-object relationship between ~~the traveling speed of~~ the vehicle and ~~the distance~~ the object and ~~the vehicle~~ that is corrected using the non-linear traveling speed based correction coefficient,

a steering avoidance possibility determining section configured to determine that the object detected in the front of the vehicle by the forward object detecting section cannot be avoided by steering when the vehicle-object relationship between the object and the vehicle matches the variable steering avoidance threshold value set by the steering avoidance threshold setting value setting section, and

a traveling speed detecting section that detects ~~the a~~ traveling speed of the vehicle,

the steering avoidance threshold value setting section being configured to set the steering avoidance threshold value for determining if the object in the front of the vehicle can be avoided by steering based on the ~~vehicle~~ traveling speed of the vehicle detected by the traveling speed detecting section.

9. (Currently Amended) The braking control device recited in claim 8, wherein the steering avoidance threshold value setting section adjusts the variable threshold value for determining if the object can be avoided by steering based on at least one of a time and the a distance between the vehicle and the object, and the steering avoidance threshold value setting section further adjusts the variable threshold value for determining if the object can be avoided based on the traveling speed of the vehicle as detected by the traveling speed detecting section such that a first threshold value is set when the traveling speed is within a low speed region, a second threshold value is set when the traveling speed is within a medium speed region, and a third threshold value is set when the traveling speed is within a high speed region, with the first threshold value for the low speed region being set larger than the second and third threshold values of the medium speed region and the high speed region, respectively, and the second threshold value for the medium speed region being set smaller than the first and third threshold values of the low speed region and high speed region, respectively.

10. (Currently Amended) The braking control device recited in claim 8, wherein the steering avoidance determining section is further configured to adjust the variable steering avoidance threshold value based on [[a]] the suspension characteristic setting set by a suspension characteristic setting section.

11. (Currently Amended) The braking control device recited in claim 8, wherein the steering avoidance determining section is further configured to adjust the variable steering avoidance threshold value based on [[a]] the steering avoidance direction force calculated by a steering avoidance direction force calculating section.

12. (Currently Amended) The braking control device recited in claim 11, wherein the steering avoidance determining section is further configured to adjust the variable steering avoidance threshold value based on [[a]] the suspension characteristic setting set by a suspension characteristic setting section.

13. (Currently Amended) The braking control device recited in claim 12, wherein the steering avoidance threshold value setting section adjusts the variable threshold value for determining if the object can be avoided by steering based on at least one of a time and the a distance between the vehicle and the object, and the steering avoidance threshold value setting section adjusts the variable threshold value for determining if the object can be avoided based on the traveling speed of the vehicle as detected by the traveling speed detecting section such that a first threshold value is set when the traveling speed is within a low speed region, a second threshold value is set when the traveling speed is within a medium speed region, and a third threshold value is set when the traveling speed is within a high speed region, with the first threshold value for the low speed region being set larger than the second and third threshold values of the medium speed region and the high speed region, respectively, and the second threshold value for the medium speed region being set smaller than the first and third threshold values of the low speed region and high speed region, respectively.

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14. (Original) The braking control device recited in claim 8, wherein the avoidance possibility determining section includes a braking avoidance determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by braking.

15. (Currently Amended) The braking control device recited in claim 14, further comprising

a throttle-fully-closed deceleration calculating section being configured to calculate ~~an~~ the accelerator pedal release deceleration that will result should ~~an~~ the accelerator pedal be released, and

the braking avoidance determining section being configured to set the ~~method by~~ ~~which~~ control operation to determine whether the object that is determined to be in the front of the vehicle can be avoided by braking based on the accelerator pedal release deceleration calculated by the throttle-fully-closed deceleration calculating section.

16. (Original) The braking control device recited in claim 2, further comprising

the avoidance possibility determining section includes a braking avoidance determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by braking.

17. (Currently Amended) A braking control device comprising:
forward object detecting means for detecting an object in front of a vehicle in which the braking control device is installed;

avoidance possibility determining means for determining if the object detected in the front of the vehicle by the forward object detecting ~~section~~ means can be avoided by at least one of steering and braking;

automatic braking means for executing automatic braking when the avoidance possibility determining means determines that the object cannot be avoided by ^{the} at least one of steering and braking; and

vehicle behavior response characteristic determining means for determining a vehicle behavior response characteristic that includes at least one of a suspension characteristic of the vehicle based on a suspension characteristic setting, a steering avoidance direction force that will be generated in the steering avoidance direction should the object detected in the front of the vehicle by the forward object detecting ~~section~~ means be avoided by steering with the steering avoidance direction force being calculated based on a longitudinal force and a load acting on wheels of the vehicle, a change in a vehicle condition that results in deceleration of the vehicle an accelerator pedal release deceleration that will result should an accelerator pedal be released, and a vehicle-object relationship between a traveling speed of the vehicle and a distance the object and the vehicle that is corrected using a non-linear traveling speed based correction coefficient,

the avoidance possibility determining means being further configured to set a ~~method by which control operation for determining whether~~ the object that is determined to be in the front of the vehicle can be avoided by at least one of steering and braking based on the vehicle behavior response characteristic determined by the vehicle behavior response characteristic determining ~~section~~ means.

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18. (Currently Amended) A method of controlling vehicle braking comprising:

detecting an object in front of a vehicle;

determining if the object detected in the front of the vehicle can be avoided by at least one of steering and braking, where an avoidance possibility determination is made based on determining a vehicle behavior response characteristic that includes at least one of a suspension characteristic of the vehicle based on a suspension characteristic setting, a steering avoidance direction force that will be generated in the steering avoidance direction should the object detected in the front of the vehicle by ^a the forward object detecting section be avoided by steering with the steering avoidance direction force being calculated based on a longitudinal force and a load acting on wheels of the vehicle, a change in a vehicle condition that results in deceleration of the vehicle an accelerator pedal release deceleration that will result should an accelerator pedal be released, and a vehicle-object relationship between ~~a traveling speed~~ of the vehicle and ~~a distance~~ the object and ~~the vehicle~~ that is corrected using a non-linear traveling speed based correction coefficient, and;

executing automatic braking upon determining that the object cannot be avoided by ^{the} at least one of steering and braking.

19. (Currently Amended) The method recited in claim 18, wherein the avoidance possibility determination is performed by

^a detecting ~~the~~ vehicle traveling speed,

setting a variable steering avoidance threshold value for determining if the object detected in front of the vehicle by the forward object detected in front of the vehicle can be avoided by steering based on the vehicle-object relationship between ~~the traveling speed of the vehicle and the distance the object and the vehicle~~ that is corrected using the non-linear traveling speed based correction coefficient, and determining that the object detected in the front of the vehicle by the forward object detecting section cannot be avoided by steering when the vehicle-object relationship between the object and the vehicle matches the variable steering avoidance threshold value based on the vehicle traveling speed detected.

20. (Currently Amended) The method recited in claim 19, wherein the avoidance possibility determination is further performed by adjusting the variable threshold value for determining if the object can be avoided by steering based on at least one of a time and ~~the a~~ distance between the vehicle and the object, and further adjusting the variable threshold value for determining if the object can be avoided based on the traveling speed of the vehicle such that a first threshold value is set when the traveling speed is within a low speed region, a second threshold value is set when the traveling speed is within a medium speed region, and a third threshold value is set when the traveling speed is within a high speed region, with the first threshold value for the low speed region being set larger than the

second and third threshold values of the medium speed region and the high speed region, respectively, and the second threshold value for the medium speed region being set smaller than the first and third threshold values of the low speed region and high speed region, respectively.

21. (Currently Amended) The method recited in claim 19, wherein further adjusting of the variable steering avoidance threshold value is based on [[a]] the suspension characteristic setting.

22. (Currently Amended) The method recited in claim 19, wherein further adjusting of the variable steering avoidance threshold value is based on [[a]] the steering avoidance direction force.

23. (Currently Amended) The method recited in claim 22, wherein further adjusting of the variable steering avoidance threshold value is based on [[a]] the suspension characteristic setting.

24. (Original) The method recited in claim 19, wherein the avoidance possibility determination is further performed by determining if the object detected in the front of the vehicle by the forward object detecting section can be avoided by braking.

25. (New) A braking control device comprising:

a forward object detecting section configured to detect an object in front of a vehicle in which the braking control device is installed;

an avoidance possibility determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by at least one of steering and braking, the avoidance possibility determining section including a steering avoidance determining section configured to determine if the object can be avoided by steering using a variable steering avoidance threshold value calculated based on a vehicle-object relationship between the vehicle and the object with the variable steering avoidance threshold value being adjusted using a non-linear traveling speed based correction coefficient; and

an automatic braking section configured to execute automatic braking when the avoidance possibility determining section determines that the object cannot be avoided by at least one of steering and braking.

26. (New) The braking control device recited in claim 25, wherein the steering avoidance determining section is further configured to adjust the steering avoidance variable threshold value based on a traveling speed of the vehicle such that a first threshold value is set when the traveling speed is within a low speed region, a second threshold value is set when the traveling speed is within a medium speed region, and a third threshold value is set when the traveling speed is within a high speed region, with the first threshold value for the low speed region being set larger than the second and the third threshold values of the medium speed region and the high speed region, respectively, and the

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second threshold value for the medium speed region being set smaller than the first and third threshold values of the low speed region and high speed region, respectively.

27. (New) The braking control device recited in claim 25, wherein the steering avoidance determining section is further configured to adjust the variable steering avoidance threshold value using a suspension characteristic of the vehicle based on a suspension characteristic setting.

28. (New) The braking control device recited in claim 25, wherein the steering avoidance determining section is further configured to adjust the variable steering avoidance threshold value using a steering avoidance direction force that will be generated in the steering avoidance direction should the object detected in the front of the vehicle by the forward object detecting section be avoided by steering.

29. (New) The braking control device recited in claim 25, wherein the avoidance possibility determining section includes a braking avoidance determining section configured to determine if the object can be avoided by braking based on a change in a vehicle condition that results in deceleration of the vehicle.